

The opinion in support of the decision being entered today was not written for publication in a law journal and is not binding precedent of the Board.

Paper No. 44

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* PAI-HUNG PAN and NANSENG JENG

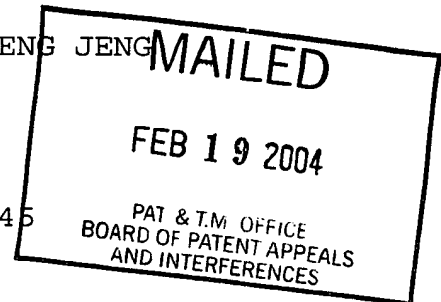
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Appeal No. 2004-0574  
Application No. 09/259,145

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ON BRIEF

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Before PAK, OWENS, and WALTZ, Administrative Patent Judges.

OWENS, Administrative Patent Judge.

DECISION ON APPEAL

This appeal is from the final rejection of claims 25, 26, 31-34, 37-40 and 43-49, which are all of the claims pending in the application.

*THE INVENTION*

The appellants claim an intermediate structure in the formation of an isolation structure for a semiconductor device, comprising a semiconductor substrate which is encapsulated by a

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substantially dopant-free, uninterrupted diffusion barrier.

Claim 33 is illustrative:

33. An intermediate structure in the formation of an isolation structure for a semiconductor device, comprising:

a semiconductor substrate having at least a portion free of field oxide structures and having a first surface and a second surface, said first surface opposing said second surface;

at least one p-well and at least one n-well on said substrate first surface;

at least one activated, annealed doped area within at least one of said at least one n-well and said at least one p-well; and

a substantially dopant-free, uninterrupted diffusion barrier layer extending over said first surface and said second surface of said semiconductor substrate, said substantially dopant-free, uninterrupted diffusion barrier layer encapsulating said semiconductor substrate.

#### THE REFERENCES

Tada	5,545,577	Aug. 13, 1996
Shim et al. (Shim)	5,846,596	Dec. 8, 1998
		(filed Feb. 4, 1997)
Koike	5,874,325	Feb. 23, 1999
		(filed Oct. 21, 1996)

Stanley Wolf and Richard N. Tauber (Wolf), 1 *Silicon Processing for the VLSI Era* 262-65 (Lattice Press 1986).

#### THE REJECTIONS

The claims stand rejected under 35 U.S.C. § 103 as follows:  
claims 25, 26, 31, 33, 34, 37-40 and 43-48 over Tada in view of Koike and Wolf, and claims 32 and 49 over Tada in view of Koike and Shim.

*OPINION*

We reverse the aforementioned rejections. We need to address only the independent claims, i.e., claims 25, 33, 39 and 46.

Each of the appellants' independent claims requires a substantially dopant-free, uninterrupted diffusion barrier layer which extends over a first surface and an opposing second surface of a semiconductor substrate and encapsulates the semiconductor substrate.

Tada discloses an intermediate structure in the formation of an isolation structure for a semiconductor device, comprising a semiconductor substrate (100) which is free of field oxide, has a first surface and an opposing second surface, and has on the first surface a p-type area (5) within an n-well (2) and an n-type area (6) within a p-well (3) (col. 6, lines 3-26; figure 2(c)). Selective oxidation is carried out using silicon nitride as a mask to form field oxide (9) (col. 6, lines 30-31; figure 3(a)). Tada does not disclose how the silicon nitride is deposited.

Koike discloses a method for making a semiconductor device wherein a gettering layer is formed to prevent deterioration of electrical characteristics of the device caused by metal impurity contamination (col. 1, lines 6-10). The gettering layer is a

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doped silicon thin film (103) and is formed on both sides of a silicon substrate (101) (col. 6, lines 56-60). The gettering layer is covered on both sides of the substrate with a protective silicon nitride film (104) (col. 7, lines 27-31; figure 11). Koike teaches that "[t]he silicon thin film to which an impurity was added, and the silicon nitride film 104 are formed generally by a reduced pressure CVD [chemical vapor deposition] method, and therefore these films are deposited on the reverse surface of the silicon substrate 101" (col. 6, line 65 - col. 7, line 2).

The examiner argues that Koike teaches that the silicon nitride film unavoidably forms on the reverse surface of the substrate, and that "[t]herefore, in view of this teaching of Koike, the silicon nitride material formed in Tada, col. 6, lines 30-31, will also form on the bottom surface of the substrate" (answer, page 4).

Koike teaches that reduced pressure CVD forms his silicon nitride film on both surfaces of the substrate. This apparently occurs because in that method the substrates are held in a wafer boat such that both substrate surfaces are exposed to the film-forming gas.<sup>1</sup> As of Tada' filing date, however, it was known in

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<sup>1</sup> See Stanley Wolf and Richard N. Tauber, *1 Silicon Processing for the VLSI Era 174-75* (Lattice Press 2000). A copy of the cited portions of this reference is provided to the appellants with this decision.

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the art to form a silicon nitride film (and a silicon oxynitride film as required by the appellants' claims 32 and 49) by plasma enhanced CVD wherein a wafer is placed on a susceptor such that its reverse surface is not exposed to the film-forming gas and, therefore, is not covered by a deposited film.<sup>2</sup>

Thus, because Tada's silicon nitride film is not disclosed as being formed by low pressure CVD, the record does not indicate that the silicon nitride film is unavoidably formed on the reverse substrate surface as argued by the examiner. The examiner has not provided evidence or reasoning which shows that Tada's silicon nitride film necessarily is formed by low pressure CVD, or that one of ordinary skill in the art would have desired to form on both substrate surfaces Tada's silicon nitride film which functions as a mask in the formation of field oxide on only one of the substrate surfaces.

For the above reasons we conclude that the examiner has not carried the burden of establishing a *prima facie* case of obviousness of the appellants' claimed invention. Accordingly, we reverse the examiner's rejections.<sup>3</sup>

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<sup>2</sup> See Wolf, *supra* note 2 at 176-80, 202-06 (citing disclosures prior to Tada's filing date).

<sup>3</sup> The examiner does not rely upon Shim or Wolf for any disclosure that remedies the above-discussed deficiency in Tada and Koike.

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### DECISION

The rejections under 35 U.S.C. § 103 of claims 25, 26, 31, 33, 34, 37-40 and 43-48 over Tada in view of Koike and Wolf, and claims 32 and 49 over Tada in view of Koike and Shim, are reversed.

REVERSED

Ernst K. Roth

CHUNG R. PAK  
Administrative Patent Judge

Terry J. Owens

TERRY J. OWENS  
Administrative Patent Judge

Thomas A. Walt

THOMAS A. WALTZ  
Administrative Patent Judge

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